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20.0.B Discussion Heat Transfer Applications

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RECORDER REPORT, Chem 444A "Fire & Ice"

Group Member Name

Role

Date: 4/7/14

<u>Charles</u>	<u>Spokesperson</u>
<u>Marisa</u>	<u>Recorder</u>
<u>Kaleigh</u>	<u>Manager</u>
<u>Tim</u>	<u>Spokesperson</u>

- 1) conduction : ashes are a poor conductor so they act as an insulator, the coals are covered by the ash
- 2) Time : walking briskly across the coals allows for as little contact with them
- 3) It's not fire walking — it's coal walking (Phitaval happens at night so it appears like fire rather than coal)
- 4) Our body has the ability to withstand some heat
- 5) Coal is made of light weight carbon atoms and air spaces; the lightweight carbon structure is a poor conductor of heat and air also has a low heat capacity and a poor thermal conductivity
- 6) Leidenfrost Effect : the moisture on the sole of the foot creates a vapor barrier that prevented the foot from actually contacting the coals

Experiment :

Inert paper acts as the coals, sand acts as the ash and is placed over the paper. We walked our fingers quickly over the paper in the sand area and clean area. The marks in the sand area indicated the heat was lower. Repeated with water on one hand and a dry hand. The wet hand left lower heat marks than the dry hand.

RECORDER REPORT, Chem 444A "Fire & Ice"

Group Member Name

Role

Date:

4/7/15

Heather

Recorder

Amanda

Spokesperson

Calé

Spokesperson

Emma

Manager

Jon

Ice

- Historical article rather than scientific
- Important to extend shelf-life of food → it took awhile to find a way to preserve ice while travelling
- Being able to ship ice created a new demand.
- They used ~~more~~ hay + sawdust as insulation. It is a bad conductor (heat takes awhile to pass through).

Properties of water

- Polarity of water makes for stronger attractions between molecules, therefore requiring more energy to break apart.
- There is a high melting point.
- ~~The ice was also more dense than water.~~ They shipped the ice in the ship below the water line, with hay and sawdust as insulation. There is less heat circulating than if it was in air.
- Issue: if you try to ship ice over a long journey, it will melt. He created refrigerated containers to preserve ice to sell at his destination.
- Water's high melting point makes it more difficult to melt. It takes more energy to melt it, which helps him transporting it.

Poster: Draw ship. Show how water's polarity plays a role.

Christopher F. Bauer, Principal Investigator.

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RECORDER REPORT, Chem 444A "Fire & Ice"

Group Member Name

Role

Date: 4/7/15

Nick Bauchard Recorder

Samantha Colaw Spokesperson

Kyle Reiser+ Spokesperson

Emily Dwyer Manager

Important Features:

Heat Sink: similar discussion to Heat Exchanger article.

- Tremendous amount of heat loss through windows.
- There is no gravity so heat doesn't rise, and there's no air flow.
- Only option of heat transfer in space is radiation whereas on Earth convection and conduction occurs.
- The ISS is covered with MLI. The ISS uses heat exchangers to allow heat generated by the equipment to be removed.
- The heat exchangers are needed to release excess heat since the ISS is close to perfect insulation with exceptions of the windows.
- Ammonia is used since it has a lower freezing point.
- There is an internal water cooling system.

Heat Sink is used to cool computers and smaller electronic devices such as the ones on the ISS.

Christopher F. Bauer, Principal Investigator

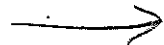
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From the Heat Exchanger Article:

- Heat is transferred "between mediums" (such as the exchangers on the ISS)



A fluid is transferred to a different temperature environment resulting in heat transfer.

ISS is designed to trap heat produced in the inside (electronics), and cool by transferring liquid to the outside to cool and then it's returned.

Heat goes in through solar energy \rightarrow electrical thermal energy (some through the window). Heat goes out through radiators (heat exchangers). Heat sinks are used on the electrical devices to keep them cool.

Questions:

How does the heat exchanger on the ISS work if it's facing the "sun side"?

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Group Member Name

Role

Date: 4/7/15

Taylor Spokesperson

Miriam Recorder

Eliza Spokesperson

Emily Manager

Amanda

Energy - saving windows → Features

- Multiple layers of glazing
- Thickness of air space
- Low-conductivity gas fill
- Tinted glass coatings
- Low-e coatings
- Edge spacers
- Global warming
 - energy efficient windows - use less energy and are better for environment

Radiation - glazing & coatings (tinted)

Conduction - glazing, gas fill, edge spacers

Convection - panes of glass, gas fillings, & warm edge spacer, thermally resistant frames

Air leakage - edge spacers

Cold Climate

(winter heating)

vs.

Warm Climate

(summer cooling)

Low-e w/ high solar heat gain coefficients

Low conductivity gas fill - reduce heat loss

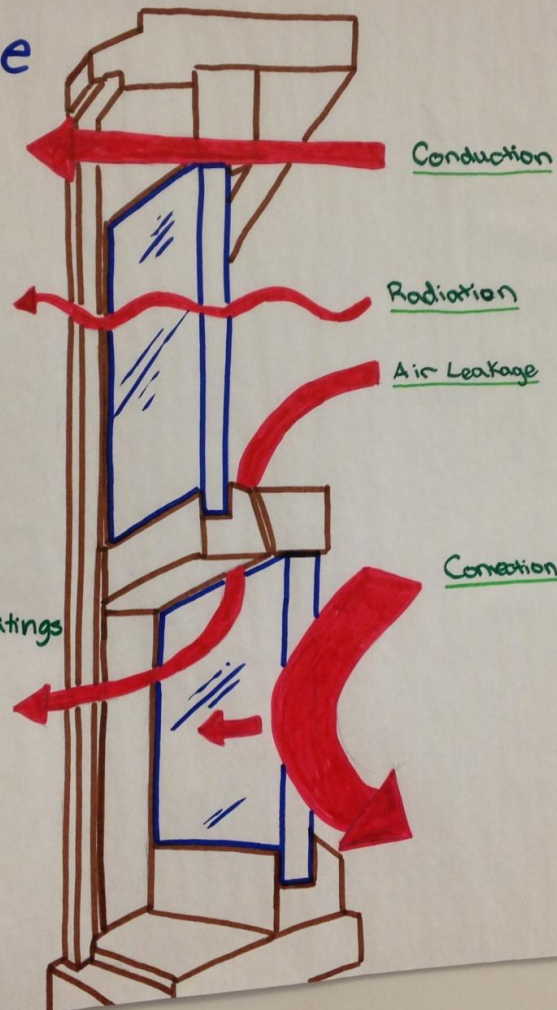
Low-e "southern" - low heat gain coefficients

Tinted glass coatings - reduce heat gain

Low conductivity gas fill

Ways to improve energy performance of Windows:

- Multiple Layers of glazing
(Radiation)
- Thickness of air space
(Conduction)
- Low Conductivity gas fill
(Conduction)
- Tinted glass coatings
(Radiation)
- Low-emissivity (low-e) coatings
(Radiation)
- Edge Spacers
(conduction)
(air leakage)



Taylor
Miriam
Eliza
Emily
Mandy

Christopher F. Bauer, Principal Investigator.

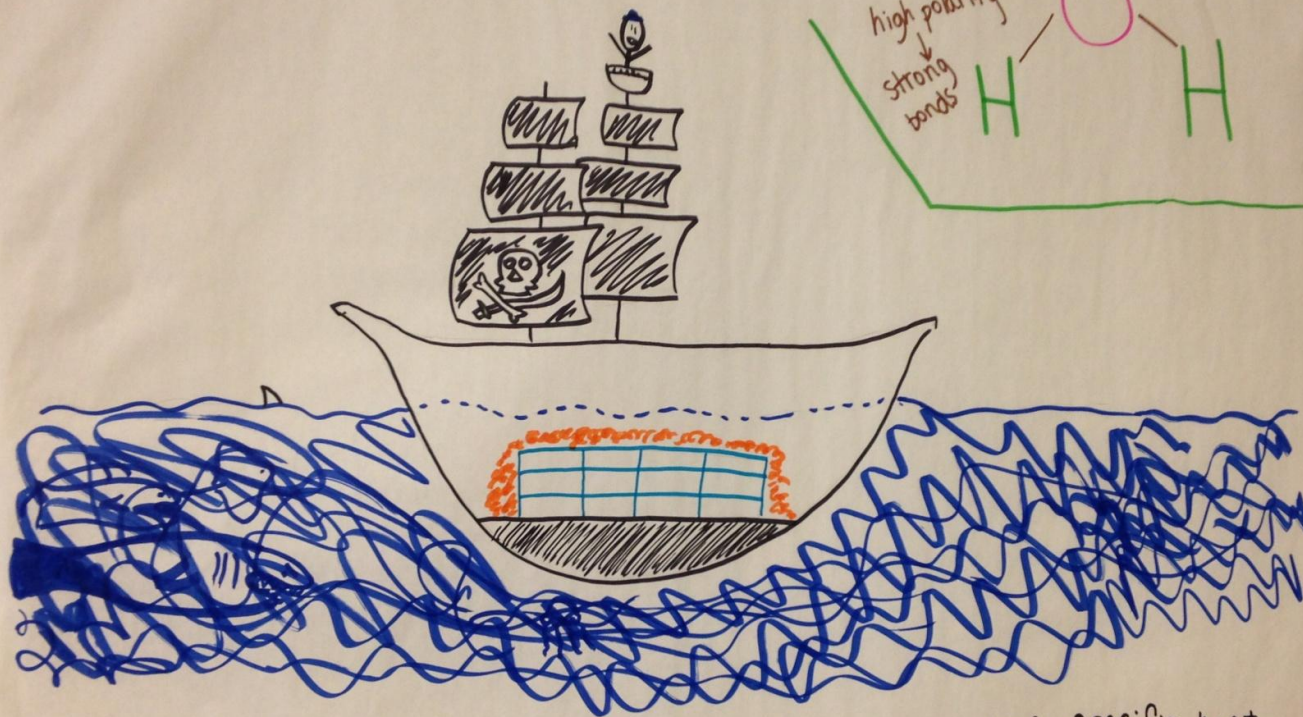
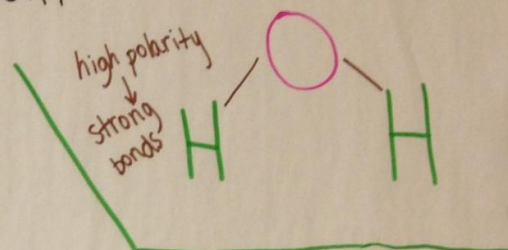
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The World That Ice Built

H₂O Molecule



- *extra bonding between water molecules gives water a large specific heat capacity, which makes water a good coolant & heat shield
- *specific enthalpy of fusion of water: $333.55 \text{ kJ} @ 0^\circ\text{C} \rightarrow$
this property gives resistance to melting ice (requires a significant amount of heat to melt it)

JON
EMMA
HEATHER
CALE
AMANDA

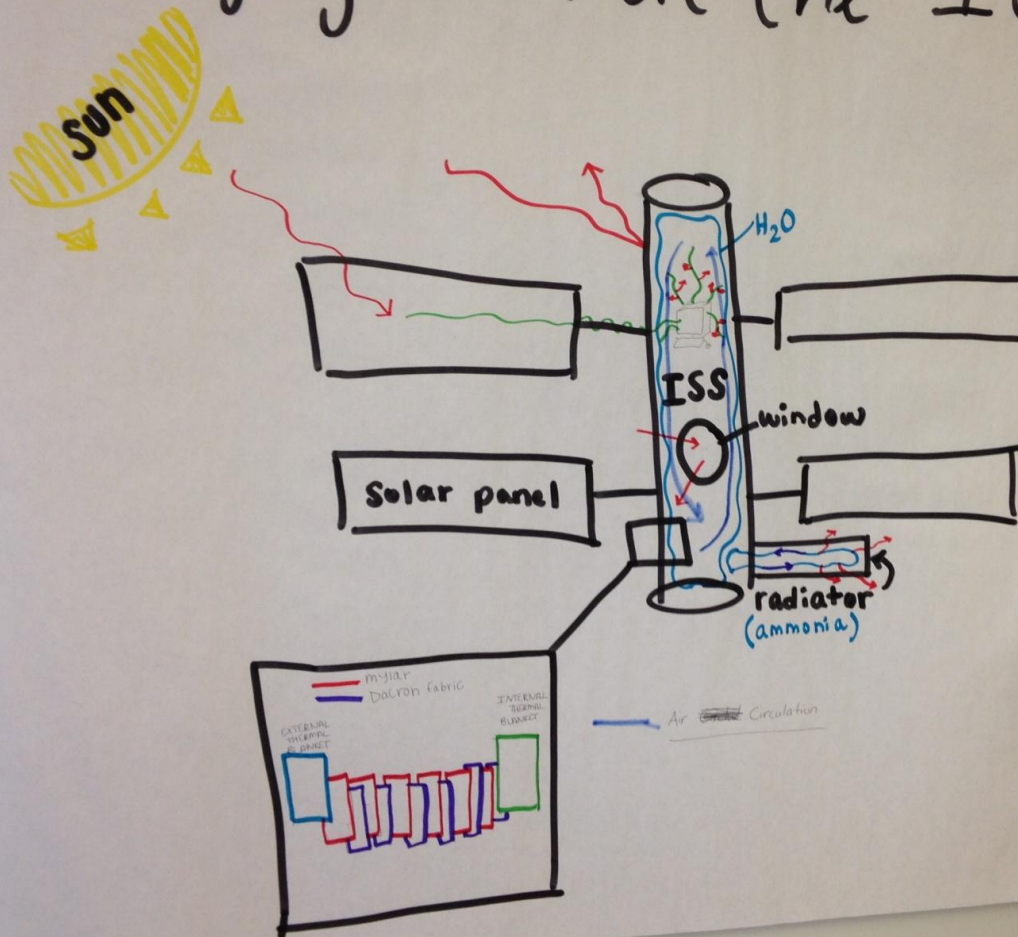
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Staying Cool on the ISS



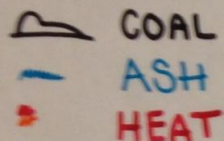
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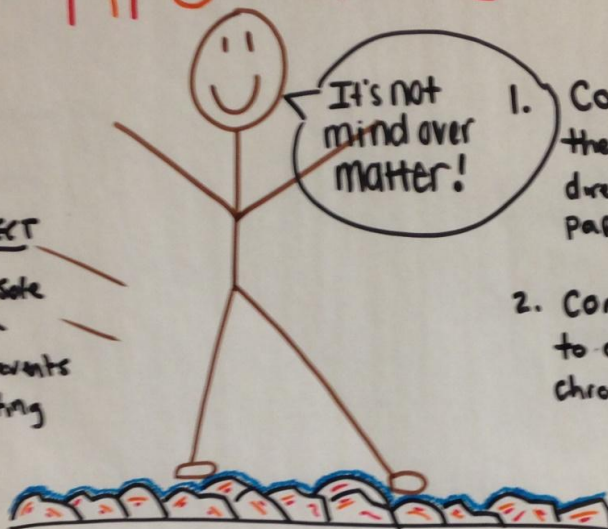
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Fire Walking



LEIENDENFROST EFFECT

- The moisture on the sole of the foot creates a vapor barrier that prevents the foot from contacting the coals. (Exp. 2)



EXPERIMENTS

1. Comparing sand on thermochromic paper to direct skin contact with paper.
2. Comparing wet fingers to dry fingers on thermochromic paper.

CONDUCTION

- Coals are a bad conductor because they are made of light weight carbon atoms and air spaces

Charles, Marisa, Tim, Kaleigh

INSULATION

- A layer of ash covers the coals and acts as a good insulator
- * Done at night because the glow of the coals can still be seen (EXPERIMENT 1)

TIME

- When walking briskly across the coals, there is less time for direct contact with the skin
- Human skin has a high heat capacity